

AMENDMENTS TO THE CLAIMS

1 -3 (Cancelled).

4. (Currently amended) An image processing device comprising:

a low-resolution image generation part generating a low resolution image from the original image, said low resolution image having a lower resolution than the original image;

a feature-value calculation part calculating a feature value with respect to an original image that is a digital image;

a character area extraction part performing a local adaptive binarization of each color component by performing a local adaptive threshold processing and an expansion processing to the low-resolution image so as to perform an extractive detection of a character area and
extracting a character area from said original image according to said feature value;

a block division part dividing said original image into blocks;

a class classification part classifying pixels belonging to said character area in each of said blocks into a first class and a second class according to colors;

a black-character-color/ground-color estimation part estimating a black character color and a ground color on said original image according to the pixels belonging to said character area being classified into said first class and said second class; and

a tone correction part performing a tone correction to said original image according to the estimated black character color and the estimated ground color.

5. (Currently amended) An image processing device comprising:

a low-resolution image generation part generating a low resolution image from the original image, said low resolution image having a lower resolution than the original image;

a feature-value calculation part calculating a feature value with respect to an original image that is a digital image;

a character area extraction part performing a local adaptive binarization of each color component by performing a local adaptive threshold processing and an expansion processing to the low-resolution image so as to perform an extractive detection of a character area and extracting a character area from said original image according to said feature value;

a block division part dividing said original image into blocks;

a class classification part classifying pixels belonging to said character area in each of said blocks into a first class and a second class according to colors;

a background color estimation part estimating a background color on said original image according to the pixels belonging to said character area being classified into said first class and said second class;

a background area specification part specifying a background area on said original image according to the estimated background color; and

a tone correction part performing a tone correction to said original image by replacing a color of the specified background area with the estimated background color.

6. (Currently amended) An image processing device comprising:

a low-resolution image generation part generating a low resolution image from the original image, said low resolution image having a lower resolution than the original image;

a feature-value calculation part calculating a feature value with respect to an original image that is a digital image;

a character area extraction part performing a local adaptive binarization of each color component by performing a local adaptive threshold processing and an expansion processing to the low-resolution image so as to perform an extractive detection of a character area and extracting a character area from said original image according to said feature value;

a block division part dividing said original image into blocks;

a class classification part classifying pixels belonging to said character area in each of said blocks into a first class and a second class according to colors;

a background color estimation part estimating a background color on said original image according to the pixels belonging to said character area being classified into said first class and said second class;

a background area specification part specifying a background area on said original image according to the estimated background color; and

a tone correction part performing a tone correction to said original image by replacing a color of the specified background area with a white color.

7. (Original) The image processing device as claimed in claim 4, wherein said feature-value calculation part calculates an average value and a standard deviation of color signals in a window set around each pixel, and

said character area extraction part extracts a pixel and pixels around said pixel as said character area according to a color signal value of said pixel in relation to a threshold value based on said average value and said standard deviation.

8. (Original) The image processing device as claimed in claim 5, wherein said feature-value calculation part calculates an average value and a standard deviation of color signals in a window set around each pixel, and

said character area extraction part extracts a pixel and pixels around said pixel as said character area according to a color signal value of said pixel in relation to a threshold value based on said average value and said standard deviation.

9. (Original) The image processing device as claimed in claim 6, wherein said feature-value calculation part calculates an average value and a standard deviation of color signals in a window set around each pixel, and

said character area extraction part extracts a pixel and pixels around said pixel as said character area according to a color signal value of said pixel in relation to a threshold value based on said average value and said standard deviation.

10. (Original) The image processing device as claimed in claim 4, wherein said feature-value calculation part calculates an edge amount of each pixel, and

said character area extraction part extracts a pixel having the edge amount equal to or larger than a predetermined threshold value, and pixels around said pixel, as said character area.

11. (Original) The image processing device as claimed in claim 5, wherein said feature-value calculation part calculates an edge amount of each pixel, and

said character area extraction part extracts a pixel having the edge amount equal to or larger than a predetermined threshold value, and pixels around said pixel, as said character area.

12. (Original) The image processing device as claimed in claim 6, wherein said feature-value calculation part calculates an edge amount of each pixel, and

said character area extraction part extracts a pixel having the edge amount equal to or larger than a predetermined threshold value, and pixels around said pixel, as said character area.

13. (Original) The image processing device as claimed in claim 4, wherein said feature-value calculation part calculates an edge amount of each pixel and calculates an average value and a standard deviation of color signals in a window set around each pixel, and

said character area extraction part extracts a pixel having the edge amount equal to or larger than a predetermined threshold value, and pixels around said pixel, as said character area, and extracts a pixel and pixels around said pixel as said character area according to a color signal value of said pixel in relation to a threshold value based on said average value and said standard deviation.

14. (Original) The image processing device as claimed in claim 5, wherein said feature-value calculation part calculates an edge amount of each pixel and calculates an average value and a standard deviation of color signals in a window set around each pixel, and

said character area extraction part extracts a pixel having the edge amount equal to or larger than a predetermined threshold value, and pixels around said pixel, as said character area, and extracts a pixel and pixels around said pixel as said character area according to a color signal value of said pixel in relation to a threshold value based on said average value and said standard deviation.

15. (Original) The image processing device as claimed in claim 6, wherein said feature-value calculation part calculates an edge amount of each pixel and calculates an average value and a standard deviation of color signals in a window set around each pixel, and

said character area extraction part extracts a pixel having the edge amount equal to or larger than a predetermined threshold value, and pixels around said pixel, as said character area, and extracts a pixel and pixels around said pixel as said character area according to a color signal value of said pixel in relation to a threshold value based on said average value and said standard deviation.

16. (Original) The image processing device as claimed in claim 4, wherein said class classification part obtains a brightness threshold value based on a brightness calculated from color signals of each of the pixels, and classifies a group of pixels each having the brightness lower than said brightness threshold value into said first class, and a group of pixels each having the brightness higher than said brightness threshold value into said second class.

17. (Original) The image processing device as claimed in claim 5, wherein said class classification part obtains a brightness threshold value based on a brightness calculated from color signals of each of the pixels, and classifies a group of pixels each having the brightness lower than said brightness threshold value into said first class, and a group of pixels each having the brightness higher than said brightness threshold value into said second class.

18. (Original) The image processing device as claimed in claim 6, wherein said class classification part obtains a brightness threshold value based on a brightness calculated from color signals of each of the pixels, and classifies a group of pixels each having the brightness lower than said brightness threshold value into said first class, and a group of pixels each having the brightness higher than said brightness threshold value into said second class.

19. (Original) The image processing device as claimed in claim 4, wherein said black-character-color/ground-color estimation part estimates an average color of a group of pixels classified into said first class in one of said blocks including a maximum number of pixels classified into said second class as the black character color, and estimates an average color of a group of said pixels classified into said second class as the ground color, according to a result of said classifying by said class classification part in each of said blocks.

20. (Original) The image processing device as claimed in claim 5, wherein said background color estimation part estimates an average color of a group of pixels classified into said second class in one of said blocks including a maximum number of said pixels classified into said second class as the background color, according to a result of said classifying by said class classification part in each of said blocks.

21. (Original) The image processing device as claimed in claim 6, wherein said background color estimation part estimates an average color of a group of pixels classified into said second class in one of said blocks including a maximum number of said pixels classified into said second class as the background color, according to a result of said classifying by said class classification part in each of said blocks.

22. (Original) The image processing device as claimed in claim 4, wherein said black-character-color/ground-color estimation part estimates an average color of a group of pixels classified into said first class in one of said blocks including said group of said pixels classified into said first class and a group of pixels classified into said second class, the groups having a maximum difference in average brightness therebetween, as the black character color, and estimates an average color of said group of said pixels classified into said second class as the ground color, according to a result of said classifying by said class classification part in each of said blocks.

23. (Original) The image processing device as claimed in claim 5, wherein said background color estimation part estimates an average color of a group of pixels classified into said second class in one of said blocks including a group of pixels classified into said first class and said group of said pixels classified into said second class, the groups having a

maximum difference in average brightness therebetween, as the background color, according to a result of said classifying by said class classification part in each of said blocks.

24. (Original) The image processing device as claimed in claim 6, wherein said background color estimation part estimates an average color of a group of pixels classified into said second class in one of said blocks including a group of pixels classified into said first class and said group of said pixels classified into said second class, the groups having a maximum difference in average brightness therebetween, as the background color, according to a result of said classifying by said class classification part in each of said blocks.

25. (Original) The image processing device as claimed in claim 16, wherein said tone correction part performs the tone correction according to a tone conversion curve based on an average value and a standard deviation of brightness in a group of pixels classified into said first class in one of said blocks including a maximum number of pixels classified into said second class, and on an average value and a standard deviation of brightness in a group of said pixels classified into said second class, according to a result of said classifying by said class classification part in each of said blocks.

26. (Original) The image processing device as claimed in claim 16, wherein said tone correction part performs the tone correction according to a tone conversion curve based on an average value and a standard deviation of brightness in a group of pixels classified into said first class in one of said blocks including said group of said pixels classified into said first class and a group of pixels classified into said second class, the groups having a maximum difference in average brightness therebetween, and on an average value and a standard deviation of brightness in said group of said pixels classified into said second class, according to a result of said classifying by said class classification part in each of said blocks.

27. (Original) The image processing device as claimed in claim 4, further comprising a low-resolution image generation part generating a low-resolution image having a lower resolution than said original image,

wherein said feature-value calculation part calculates the feature value from said low-resolution image, and

said character area extraction part extracts said character area from said low-resolution image.

28. (Original) The image processing device as claimed in claim 5, further comprising a low-resolution image generation part generating a low-resolution image having a lower resolution than said original image,

wherein said feature-value calculation part calculates the feature value from said low-resolution image, and

said character area extraction part extracts said character area from said low-resolution image.

29. (Original) The image processing device as claimed in claim 6, further comprising a low-resolution image generation part generating a low-resolution image having a lower resolution than said original image,

wherein said feature-value calculation part calculates the feature value from said low-resolution image, and

said character area extraction part extracts said character area from said low-resolution image.

30 – 61 (Cancelled).

62. (Currently amended) A computer readable recording medium storing an image processing program interpreted by a computer so as to cause said computer to perform:

a low-resolution image generation function of generating a low resolution image from the original image, said low resolution image having a lower resolution than said original image;

a feature-value calculation function of calculating a feature value with respect to an original image that is a digital image;

a character area extraction function of performing a local adaptive binarization of each color component by performing a local adaptive threshold processing and an expansion processing to the low-resolution image so as to perform an extractive detection of a character area and extracting a character area from said original image according to said feature value;

a block division function of dividing said original image into blocks;

a class classification function of classifying pixels belonging to said character area in each of said blocks into a first class and a second class according to colors;

a black-character-color/ground-color estimation function of estimating a black character color and a ground color on said original image according to the pixels belonging to said character area being classified into said first class and said second class; and

a tone correction function of performing a tone correction to said original image according to the estimated black character color and the estimated ground color.

63. (Currently amended) A computer readable recording medium storing an image processing program interpreted by a computer so as to cause said computer to perform:

a low-resolution image generation function of generating a low resolution image from the original image, said low resolution image having a lower resolution than said original image;

a feature-value calculation function of calculating a feature value with respect to an original image that is a digital image;

a character area extraction function of performing a local adaptive binarization of each color component by performing a local adaptive threshold processing and an expansion processing to the low-resolution image so as to perform an extractive detection of a character area and extracting a character area from said original image according to said feature value;

a block division function of dividing said original image into blocks;

a class classification function of classifying pixels belonging to said character area in each of said blocks into a first class and a second class according to colors;

a background color estimation function of estimating a background color on said original image according to the pixels belonging to said character area being classified into said first class and said second class;

a background area specification function of specifying a background area on said original image according to the estimated background color; and

a tone correction function of performing a tone correction to said original image by replacing a color of the specified background area with the estimated background color.

64. (Currently amended) A computer readable recording medium storing an image processing program interpreted by a computer so as to cause said computer to perform:

a low-resolution image generation function of generating a low resolution image from the original image, said low resolution image having a lower resolution than said original image;

a feature-value calculation function of calculating a feature value with respect to an original image that is a digital image;

a character area extraction function of performing a local adaptive binarization of each color component by performing a local adaptive threshold processing and an expansion

processing to the low-resolution image so as to perform an extractive detection of a character area and extracting a character area from said original image according to said feature value;

a block division function of dividing said original image into blocks;

a class classification function of classifying pixels belonging to said character area in each of said blocks into a first class and a second class according to colors;

a background color estimation function of estimating a background color on said original image according to the pixels belonging to said character area being classified into said first class and said second class;

a background area specification function of specifying a background area on said original image according to the estimated background color; and

a tone correction function of performing a tone correction to said original image by replacing a color of the specified background area with a white color.

65. (Original) The computer readable recording medium as claimed in claim 62, wherein an average value and a standard deviation of color signals in a window set around each pixel are calculated by said feature-value calculation function, and

a pixel and pixels around said pixel are extracted as said character area by said character area extraction function according to a color signal value of said pixel in relation to a threshold value based on said average value and said standard deviation.

66. (Original) The computer readable recording medium as claimed in claim 63, wherein an average value and a standard deviation of color signals in a window set around each pixel are calculated by said feature-value calculation function, and

a pixel and pixels around said pixel are extracted as said character area by said character area extraction function according to a color signal value of said pixel in relation to a threshold value based on said average value and said standard deviation.

67. (Original) The computer readable recording medium as claimed in claim 64, wherein an average value and a standard deviation of color signals in a window set around each pixel are calculated by said feature-value calculation function, and

a pixel and pixels around said pixel are extracted as said character area by said character area extraction function according to a color signal value of said pixel in relation to a threshold value based on said average value and said standard deviation.

68. (Original) The computer readable recording medium as claimed in claim 62, wherein an edge amount of each pixel is calculated by said feature-value calculation function, and

a pixel having the edge amount equal to or larger than a predetermined threshold value, and pixels around said pixel, are extracted as said character area by said character area extraction function.

69. (Original) The computer readable recording medium as claimed in claim 63, wherein an edge amount of each pixel is calculated by said feature-value calculation function, and

a pixel having the edge amount equal to or larger than a predetermined threshold value, and pixels around said pixel, are extracted as said character area by said character area extraction function.

70. (Original) The computer readable recording medium as claimed in claim 64, wherein an edge amount of each pixel is calculated by said feature-value calculation function, and

a pixel having the edge amount equal to or larger than a predetermined threshold value, and pixels around said pixel, are extracted as said character area by said character area extraction function.

71. (Original) The computer readable recording medium as claimed in claim 62, wherein an edge amount of each pixel, and an average value and a standard deviation of color signals in a window set around each pixel are calculated by said feature-value calculation function, and

a pixel having the edge amount equal to or larger than a predetermined threshold value, and pixels around said pixel, are extracted as said character area by said character area extraction function, and a pixel and pixels around said pixel are extracted as said character area by said character area extraction function according to a color signal value of said pixel in relation to a threshold value based on said average value and said standard deviation.

72. (Original) The computer readable recording medium as claimed in claim 63, wherein an edge amount of each pixel, and an average value and a standard deviation of color signals in a window set around each pixel are calculated by said feature-value calculation function, and

a pixel having the edge amount equal to or larger than a predetermined threshold value, and pixels around said pixel, are extracted as said character area by said character area extraction function, and a pixel and pixels around said pixel are extracted as said character area by said character area extraction function according to a color signal value of said pixel in relation to a threshold value based on said average value and said standard deviation.

73. (Original) The computer readable recording medium as claimed in claim 64, wherein an edge amount of each pixel, and an average value and a standard deviation of

color signals in a window set around each pixel are calculated by said feature-value calculation function, and

a pixel having the edge amount equal to or larger than a predetermined threshold value, and pixels around said pixel, are extracted as said character area by said character area extraction function, and a pixel and pixels around said pixel are extracted as said character area by said character area extraction function according to a color signal value of said pixel in relation to a threshold value based on said average value and said standard deviation.

74. (Original) The computer readable recording medium as claimed in claim 62, wherein a brightness threshold value is obtained according to a brightness calculated from color signals of each of the pixels by said class classification function, and a group of pixels each having the brightness lower than said brightness threshold value are classified into said first class, and a group of pixels each having the brightness higher than said brightness threshold value are classified into said second class by said class classification function.

75. (Original) The computer readable recording medium as claimed in claim 63, wherein a brightness threshold value is obtained according to a brightness calculated from color signals of each of the pixels by said class classification function, and a group of pixels each having the brightness lower than said brightness threshold value are classified into said first class, and a group of pixels each having the brightness higher than said brightness threshold value are classified into said second class by said class classification function.

76. (Original) The computer readable recording medium as claimed in claim 64, wherein a brightness threshold value is obtained according to a brightness calculated from color signals of each of the pixels by said class classification function, and a group of pixels each having the brightness lower than said brightness threshold value are classified into said

first class, and a group of pixels each having the brightness higher than said brightness threshold value are classified into said second class by said class classification function.

77. (Original) The computer readable recording medium as claimed in claim 62, wherein an average color of a group of pixels classified into said first class in one of said blocks including a maximum number of pixels classified into said second class is estimated as the black character color by said black-character-color/ground-color estimation function, and an average color of a group of said pixels classified into said second class is estimated as the ground color by said black-character-color/ground-color estimation function, according to a result of said classifying by said class classification function in each of said blocks.

78. (Original) The computer readable recording medium as claimed in claim 63, wherein an average color of a group of pixels classified into said second class in one of said blocks including a maximum number of said pixels classified into said second class is estimated as the background color by said background color estimation function, according to a result of said classifying by said class classification function in each of said blocks.

79. (Original) The computer readable recording medium as claimed in claim 64, wherein an average color of a group of pixels classified into said second class in one of said blocks including a maximum number of said pixels classified into said second class is estimated as the background color by said background color estimation function, according to a result of said classifying by said class classification function in each of said blocks.

80. (Original) The computer readable recording medium as claimed in claim 62, wherein an average color of a group of pixels classified into said first class in one of said blocks including said group of said pixels classified into said first class and a group of pixels classified into said second class, the groups having a maximum difference in average brightness

therebetween, is estimated as the black character color by said black-character-color/ground-color estimation function, and an average color of said group of said pixels classified into said second class is estimated as the ground color by said black-character-color/ground-color estimation function, according to a result of said classifying by said class classification function in each of said blocks.

81. (Original) The computer readable recording medium as claimed in claim 63, wherein an average color of a group of pixels classified into said second class in one of said blocks including a group of pixels classified into said first class and said group of said pixels classified into said second class, the groups having a maximum difference in average brightness therebetween, is estimated as the background color by said background color estimation function, according to a result of said classifying by said class classification function in each of said blocks.

82. (Original) The computer readable recording medium as claimed in claim 64, wherein an average color of a group of pixels classified into said second class in one of said blocks including a group of pixels classified into said first class and said group of said pixels classified into said second class, the groups having a maximum difference in average brightness therebetween, is estimated as the background color by said background color estimation function, according to a result of said classifying by said class classification function in each of said blocks.

83. (Original) The computer readable recording medium as claimed in claim 74, wherein the tone correction is performed by said tone correction function according to a tone conversion curve based on an average value and a standard deviation of brightness in a group of pixels classified into said first class in one of said blocks including a maximum number of pixels classified into said second class, and on an average value and a standard deviation of brightness

in a group of said pixels classified into said second class, according to a result of said classifying by said class classification function in each of said blocks.

84. (Original) The computer readable recording medium as claimed in claim 74, wherein the tone correction is performed by said tone correction function according to a tone conversion curve based on an average value and a standard deviation of brightness in a group of pixels classified into said first class in one of said blocks including said group of said pixels classified into said first class and a group of pixels classified into said second class, the groups having a maximum difference in average brightness therebetween, and on an average value and a standard deviation of brightness in said group of said pixels classified into said second class, according to a result of said classifying by said class classification function in each of said blocks.

85. (Original) The computer readable recording medium as claimed in claim 62, wherein the image processing program further causes said computer to perform a low-resolution image generation function of generating a low-resolution image having a lower resolution than said original image,

wherein the feature value is calculated from said low-resolution image by said feature-value calculation function, and

said character area is extracted from said low-resolution image by said character area extraction function.

86. (Original) The computer readable recording medium as claimed in claim 63, wherein the image processing program further causes said computer to perform a low-resolution image generation function of generating a low-resolution image having a lower resolution than said original image,

wherein the feature value is calculated from said low-resolution image by said feature-value calculation function, and

said character area is extracted from said low-resolution image by said character area extraction function.

87. (Original) The computer readable recording medium as claimed in claim 64, wherein the image processing program further causes said computer to perform a low-resolution image generation function of generating a low-resolution image having a lower resolution than said original image,

wherein the feature value is calculated from said low-resolution image by said feature-value calculation function, and

said character area is extracted from said low-resolution image by said character area extraction function.